

# Industrial Engineering and Management, Master's Programme

120 credits

Industrial Engineering and Management,  
masterprogram

6MIND

Valid from: 2017 Spring semester

**Determined by**  
Faculty Board of Institute of Technology

**Date determined**  
2017-01-25

## Purpose

- An MSc in Industrial Engineering and Management from Linköping University is able to identify, analyse, solve and communicate complex interdisciplinary problems issues in industry, with a focus on integrating engineering and management knowledge and skills.
- The master's program in Industrial Engineering and Management will become one of the leading international master programs. The courses in the program shall be on a level comparable to similar courses provided within other relevant, excellent international education programs.
- The master's program in Industrial Engineering and Management will be the obvious choice for students who have a Bachelor of Science degree in an engineering subject and who have the ambition to increase and deepen their knowledge in industrial engineering and management, especially related to innovation management, operations management and quality management.

## Aim

After the completion of the master program the student is expected to have acquired the following knowledge and skills:

### Technical knowledge and reasoning

An MSc in Industrial Engineering and Management from Linköping University is able to manage complex interdisciplinary problems related to innovation and operations management. From a thorough technical-economical-mathematical-management basis, an MSc is able to identify, analyse, solve and communicate problems related to innovation and operations management.

Knowledge of underlying sciences, core engineering fundamental knowledge, and advanced engineering knowledge

Students with Bachelors of Science in an engineering subject entering the program have already studied in-depth courses within a certain engineering discipline, e.g. mechanical engineering, electrical engineering, software engineering or industrial engineering, including at least 30 ECTS credits in mathematics and applied mathematics. In the master program there is a possibility to deepen the knowledge within these areas mainly in facultative courses, and to attain knowledge in managing complex industrial problems. Consequently, an MSc in Industrial Engineering and Management is able to describe, formulate, and analyse industrial problems by using mathematical tools and technological applications.

### In-depth knowledge in one/some applied subject areas

The above-mentioned advanced engineering knowledge should be further enhanced by integrating knowledge in organization management, operations strategy, leadership, finance, operations planning and control, quality management, and project management. In addition to general, compulsory courses in these fields, an MSc in Industrial Engineering and Management from Linköping University has in-depth knowledge within one of the programme's specialisations. Within the chosen specialisation, an MSc in Industrial Engineering and Management is able to:

- analyse complex problems based on relevant theory and practical knowledge
- relate and synthesize different theoretical perspectives and develop their own models of analysis
- apply academic principles, models and methodologies in industrial firms
- critically assess methods, procedures and practices that are applied in technology based firms

#### Personal and professional skills and attributes

An MSc in Industrial Engineering and Management has the individual and professional capability and attitude to take a leading role in dynamic industrial environments.

#### Engineering reasoning and problem solving

An MSc in Industrial Engineering and Management is able to identify, formulate and examine complex engineering problems in a systematic way, both quantitatively and qualitatively.

#### System thinking

An MSc in Industrial Engineering and Management is able to identify, analyse and develop complex systems by defining the system's boundaries and properties, considering the whole system as well as subsystems and describing and examining the interaction between the different parts in the system including its important context variables.

#### Experimentation and knowledge discovery

An MSc in Industrial Engineering and Management is able to adopt new knowledge by using relevant literature and performing quantitative as well as qualitative empirical studies. Quantitative empirical studies based on hypotheses can be tested in experiments as well as through statistical analyses. Qualitative studies include case studies which can be used to create theoretical constructs and propositions.

#### Personal skills and attitudes

An MSc in Industrial Engineering and Management is able to take initiatives, work independently, creatively and to apply critical thinking. Self-knowledge and a will to develop personally throughout life are important. An MSc is also able to plan her/his time and resources in an efficient and effective way.

#### Professional skills and attitudes

An MSc in Industrial Engineering and Management takes responsibility, is reliable and acts professionally. This includes being active in career planning and keeping up-to-date with the profession's current developments.

#### Interpersonal skills, teamwork, and communication

An MSc in Industrial Engineering and Management is trained to collaboratively work on complex tasks. Interpersonal skills, teamwork and communication are therefore of utmost importance.

#### Teamwork

An MSc in Industrial Engineering and Management is trained to work together with other people in projects and groups. This includes contributing to group effectiveness by actively taking part, creating clear roles and responsibilities, actively sharing knowledge and collaboratively achieving goals. An MSc in

Industrial Engineering and Management is able to start, plan, manage and lead different types of projects and integrate the work of people from different specializations.

#### Communication and communication in English

An MSc in Industrial Engineering and Management is able to communicate, orally and in writing, in a correct, inspiring way orientated towards achieving goals. Effective communication is comprised of both task-related and relationship oriented skills. As the program is given in English, an MSc in Industrial Engineering and Management is proficient enough in English to take into account the state-of-the art knowledge within the field and, based on this knowledge, understand, analyse, compare, and reflect on complex engineering problems, in written text and orally.

#### Conceiving, designing, implementing and operating systems in the enterprise and societal context

An MSc in Industrial Engineering and Management has deep knowledge of systems in an innovation or operations environment, including different external factors in society, the prerequisites of the business context. An MSc in Industrial Engineering and Management is able to participate and actively contribute to all phases of the development of these systems, including conceiving, designing, implementing and operating them.

#### External and societal context

An MSc in Industrial Engineering and Management understands the importance of technology in society, including economic, social, and sustainable development.

#### Enterprise and business context

An MSc in Industrial Engineering and Management has deep knowledge regarding management of enterprises and regarding important factors in international business contexts.

#### Conceiving and engineering systems

An MSc in Industrial Engineering and Management has the knowledge and skills needed to determine requirements for systems and products and is able to understand and evaluate systems in an industrial context.

#### Designing

An MSc in Industrial Engineering and Management has knowledge about suitable development processes for different kinds of systems.

#### Implementing

An MSc in Industrial Engineering and Management is able to design and manage implementation processes by testing, validating and verifying activities, including an understanding of change processes and the formulation of strategies to overcome resistance to change.

#### Operating

An MSc in Industrial Engineering and Management has the knowledge and skills needed to design, optimize and manage operations and service of technically advanced systems.

## Content

The program starts with one semester of compulsory courses. From the second semester, the students select a specialization within the field of Industrial Engineering and Management. Each specialization consists of compulsory and elective courses. The specialization concludes with a master's thesis of 30 ECTS in semester four.

Specialisations within the Programme

The following specialisations are offered in the programme curriculum:

- Environmental Innovation Management
- Operations Management

The scope of each specialisation is 90 ECTS, including compulsory, elective and conditionally elective courses as well as the master's thesis. Conditionally elective courses are marked o/v in the curriculum meaning that one of the courses is compulsory.

Environmental Innovation Management:

The environmental innovation management specialisation focuses on the development and commercialization of resource efficient products and sustainable solutions. It deals with innovation within large established firms as well as smaller entrepreneurial start-up firms. The students follow subjects in management systems and sustainability, innovation management, resource efficient products, industrial ecology, leadership and organization, and business planning and entrepreneurship. The specialisation and the program conclude with a master's thesis of 30 ECTS within the field of environmental innovation management.

Operations Management:

The objective of this specialisation is to provide a holistic view of operations management issues in both manufacturing and service industries. It also provides knowledge about approaches for creating and sustaining an effective organisation. The specialisation includes courses focusing on both quality and production aspects. The quality management courses encompass concepts and practices characterized by core principles such as customer focus, process management, continuous improvement, everyone's participation, base decisions on facts and committed leadership. One of the central questions is how an organisation can improve its processes to provide maximum benefits to customers through the best use of available resources. The emphasis in the production courses is to address technological trends and developments and to explore economic and engineering consequences of operations decisions. The students follow subjects in e.g. operations strategy, quality control and lean production and also have a variety of courses to choose from, such as advanced planning and scheduling, entrepreneurship, innovation management and product and service development. The specialisation and the program conclude with a master's thesis of 30 ECTS within the field of operations management.

## Entry requirements

- Bachelor's degree with a major in an engineering subject
- 30 ECTS credits in mathematics/applied mathematics and/or application of mathematics relevant for the programme, including courses in linear algebra, calculus and mathematical statistics
- English corresponding to the level of English in Swedish upper secondary education (English 6/B)

## Degree thesis

The thesis should be based on the high quality scientific content and carried out in close contact with the research groups involved in the programme and in the area of the specialisation chosen by the student. The thesis should be written and presented in English. The main subject of studies for the thesis work should be Industrial Engineering and Management.

To be qualified to conduct a degree project, the student must be admitted to the master's programme and have completed at least 60 credits from courses within the programme, of which 30 credits must be at the advanced (graduate) level within the main subject of studies.

## Degree requirements

- All compulsory and elective courses from the curriculum completed so that 120 ECTS is reached
- At least 90 ECTS on advanced level within the chosen specialisation, where 30 ECTS courses and 30 ECTS master's thesis are in the main subject of studies Industrial Engineering and Management
- Master's thesis (30 ECTS) on advanced level, in the main subject of studies Industrial Engineering and Management, examined at Linköping Institute of Technology

Courses with overlapping content are not allowed to be included in the degree. Courses included in the Bachelor's degree can never be included in the Master's degree.

## Degree in Swedish

Master of Science (120 credits) with a major in Industrial Engineering and Management

## Degree in English

Master of Science (two years) with a major in Industrial Engineering and Management

## Common rules

See also common rules

# Curriculum

## Semester 1 (Autumn 2017)

| Course code     | Course name                                 | Credits | Level | Timetable module | ECV |
|-----------------|---|---------|-------|------------------|-----|
| <b>Period 1</b> |   |         |       |                  |     |
| TEIO32          | Project Management and Organization         | 6*      | G2X   | 3                | C   |
| TKMJ14          | Large Technical Systems and the Environment | 6       | A1X   | 1                | C   |
| TMQU03          | Quality Management and Engineering          | 6       | G2X   | 2                | C   |
| <b>Period 2</b> |   |         |       |                  |     |
| TEIO32          | Project Management and Organization         | 6*      | G2X   | 1                | C   |
| TKMJ28          | Management Systems and Sustainability       | 6       | A1X   | 2                | C   |
| TPPE82          | Manufacturing Planning and Control          | 6       | G2X   | 3                | C   |

## Semester 2 (Spring 2018)

| Course code     | Course name   | Credits | Level | Timetable module | ECV |
|-----------------|---|---------|-------|------------------|-----|
| <b>Period 1</b> |   |         |       |                  |     |
| TEIO13          | Leadership and Organizational Change                      | 6       | A1X   | 4                | E   |
| TKMJ10          | Industrial Ecology  | 6       | A1X   | 1                | E   |
| TMQU31          | Statistical Quality Control                               | 6       | A1X   | 2                | E   |
| TPMM04          | Operations Strategy                                       | 6       | A1X   | 3                | E   |
| TPPE78          | Quantitative Models and Analysis in Operations Management | 6       | A1X   | 1                | E   |
| <b>Period 2</b> |   |         |       |                  |     |
| TEIO06          | Innovative Entrepreneurship                               | 6       | A1X   | 2                | E   |
| TEIO41          | Corporate Social Responsibility                           | 6       | A1X   | 3                | E   |
| TKMJ29          | Resource Efficient Products                               | 6       | A1N   | 1                | E   |
| TMQU04          | Six Sigma Quality   | 6       | A1X   | 2                | E   |
| TPPE74          | Design and Development of Manufacturing Operations        | 6       | A1X   | 4                | E   |



*Specialisation: Environmental Innovation Management*

| Course code     | Course name                          | Credits | Level | Timetable module | ECV |
|-----------------|--------------------------------------|---------|-------|------------------|-----|
| <b>Period 1</b> |                                      |         |       |                  |     |
| TEIO13          | Leadership and Organizational Change | 6       | A1X   | 4                | C   |
| TKMJ10          | Industrial Ecology                   | 6       | A1X   | 1                | C   |
| <b>Period 2</b> |                                      |         |       |                  |     |
| TEIO06          | Innovative Entrepreneurship          | 6       | A1X   | 2                | C   |
| TEIO41          | Corporate Social Responsibility      | 6       | A1X   | 3                | C   |
| TKMJ29          | Resource Efficient Products          | 6       | A1N   | 1                | C   |

*Specialisation: Operations Management*

| Course code     | Course name   | Credits | Level | Timetable module | ECV |
|-----------------|---|---------|-------|------------------|-----|
| <b>Period 1</b> |   |         |       |                  |     |
| TMQU31          | Statistical Quality Control                               | 6       | A1X   | 2                | C   |
| TPMM04          | Operations Strategy                                       | 6       | A1X   | 3                | C   |
| TEIO13          | Leadership and Organizational Change                      | 6       | A1X   | 4                | E   |
| TPPE78          | Quantitative Models and Analysis in Operations Management | 6       | A1X   | 1                | E   |
| <b>Period 2</b> |   |         |       |                  |     |
| TEIO41          | Corporate Social Responsibility                           | 6       | A1X   | 3                | C   |
| TEIO06          | Innovative Entrepreneurship                               | 6       | A1X   | 2                | E   |
| TKMJ29          | Resource Efficient Products                               | 6       | A1N   | 1                | E   |
| TMQU04          | Six Sigma Quality   | 6       | A1X   | 2                | E   |
| TPPE74          | Design and Development of Manufacturing Operations        | 6       | A1X   | 4                | E   |

## Semester 3 (Autumn 2018)

| Course code     | Course name                                      | Credits | Level | Timetable module | ECV |
|-----------------|--|---------|-------|------------------|-----|
| <b>Period 1</b> |  |         |       |                  |     |
| TMQU14          | Philosophy of Science and Research Methodology   | 6*      | A1X   | 1                | C   |
| TEIO07          | Project Based Organization and Management        | 6       | A1X   | 4                | E   |
| TEIO89          | Innovation and Entrepreneurship - Project Course | 12*     | A1F   | 4                | E   |
| TEIO90          | Innovation Management                            | 6       | A1X   | 2                | E   |
| TMKT78          | Product Development                              | 6       | G2X   | 1                | E   |
| TMQU13          | Customer Focused Product and Service Development | 6       | A1X   | 4                | E   |
| TMQU27          | Quality Management - Project Course              | 12*     | A1X   | 2                | E   |
| TPPE73          | Operations Management - Project Course           | 12*     | A1X   | 4                | E   |
| TPPE99          | Simulation in Production and Logistics           | 6       | A1X   | 3                | E   |
| <b>Period 2</b> |  |         |       |                  |     |
| TMQU14          | Philosophy of Science and Research Methodology   | 6*      | A1X   | 1                | C   |
| TEIO89          | Innovation and Entrepreneurship - Project Course | 12*     | A1F   | 4                | E   |
| TKMJ32          | Integrated Product Service Engineering           | 6       | A1N   | 3                | E   |
| TMES51          | International Energy Markets                     | 6       | A1X   | 1                | E   |
| TMQU12          | Lean Production                                  | 6       | A1X   | 2                | E   |
| TMQU27          | Quality Management - Project Course              | 12*     | A1X   | 4                | E   |
| TPPE73          | Operations Management - Project Course           | 12*     | A1X   | 4                | E   |

*Specialisation: Environmental Innovation Management*

| Course code     | Course name                                      | Credits | Level | Timetable module | ECV |
|-----------------|--|---------|-------|------------------|-----|
| <b>Period 1</b> |  |         |       |                  |     |
| TEIO89          | Innovation and Entrepreneurship - Project Course | 12*     | A1F   | 4                | C   |
| TEIO90          | Innovation Management                            | 6       | A1X   | 2                | C   |
| TMQU14          | Philosophy of Science and Research Methodology   | 6*      | A1X   | 1                | C   |
| <b>Period 2</b> |  |         |       |                  |     |
| TEIO89          | Innovation and Entrepreneurship - Project Course | 12*     | A1F   | 4                | C   |
| TMQU14          | Philosophy of Science and Research Methodology   | 6*      | A1X   | 1                | C   |
| TKMJ32          | Integrated Product Service Engineering           | 6       | A1N   | 3                | E   |
| TMES51          | International Energy Markets                     | 6       | A1X   | 1                | E   |

*Specialisation: Operations Management*

| Course code     | Course name                                      | Credits | Level | Timetable module | ECV |
|-----------------|--|---------|-------|------------------|-----|
| <b>Period 1</b> |  |         |       |                  |     |
| TMQU14          | Philosophy of Science and Research Methodology   | 6*      | A1X   | 1                | C   |
| TMQU27          | Quality Management - Project Course              | 12*     | A1X   | 2                | C/E |
| TPPE73          | Operations Management - Project Course           | 12*     | A1X   | 4                | C/E |
| TEIO07          | Project Based Organization and Management        | 6       | A1X   | 4                | E   |
| TEIO90          | Innovation Management                            | 6       | A1X   | 2                | E   |
| TMKT78          | Product Development                              | 6       | G2X   | 1                | E   |
| TMQU13          | Customer Focused Product and Service Development | 6       | A1X   | 4                | E   |
| TPPE99          | Simulation in Production and Logistics           | 6       | A1X   | 3                | E   |
| <b>Period 2</b> |  |         |       |                  |     |
| TMQU12          | Lean Production                                  | 6       | A1X   | 2                | C   |
| TMQU14          | Philosophy of Science and Research Methodology   | 6*      | A1X   | 1                | C   |
| TMQU27          | Quality Management - Project Course              | 12*     | A1X   | 4                | C/E |
| TPPE73          | Operations Management - Project Course           | 12*     | A1X   | 4                | C/E |

## Semester 4 (Spring 2019)

| Course code     | Course name                      | Credits | Level | Timetable module | ECV |
|-----------------|----------------------------------|---------|-------|------------------|-----|
| <b>Period 1</b> |                                  |         |       |                  |     |
| TQXX30          | Degree project - Master's Thesis | 30*     | A1X   | -                | C   |
| <b>Period 2</b> |                                  |         |       |                  |     |
| TQXX30          | Degree project - Master's Thesis | 30*     | A1X   | -                | C   |

ECV = Elective / Compulsory / Voluntary

\*The course is divided into several semesters and/or periods